MULTIMEDIA UNIVERSITY®

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (Term 2215)

HBC1011 – BIOCHEMISTRY I

18 FEBRUARY 2023
9:00 AM – 11:00 AM
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This paper consists of **4 pages** (including the front page)
2. This paper consists of **4 Short Answer Type questions**. All questions carry equal marks (10 marks per question).
3. Answer **ALL QUESTIONS.**
4. Print your answers **clearly** and **neatly** in the Answer Booklet provided.
5. You may use calculator in this examination.

Question 1

A. Describe briefly the FOUR basic types of weak interactions encountered in biochemistry. [2 marks]

B. What is the role of oxygen in the evolution of life? [1 mark]

C. RNA is often characterized as being the first "biologically active" molecule. What TWO properties does RNA display that are important to the evolution of life? [1 mark]

D. What is the difference between cohesion and adhesion of the water properties? [1 mark]

E. What is an electronegative atom? [1 mark]

F. If an aqueous solution has a hydrogen ion concentration of 10^{-5} M, what is the concentration of hydroxyl ion? [1 mark]

G. You need to carry out an enzymatic reaction at pH 7.5. You are given buffer A, B and C with the indicated pK_a values shown in the following table. Which buffer will you use? Explain your answer briefly. [1 mark]

Buffer	pK_a
A	3.1
	4.7
	5.4
B	8.3
C	9.2

H. You are given a 100 mM NaCl stock solution. How do you prepare 4.5X dilution of NaCl solution with a final volume of 100 ml? Show your calculation. [1 mark]

I. In healthy mammalian tissue, the ratios of NAD^+/NADH and $NADP^+$/NADPH are important to maintain the redox state of a cell. Identify the predominant species in the cytoplasm. [1 mark]

Question 2

A. Why don't we indicate the side chains of the amino acids that form the peptide bond? [1 mark]

B. What is the function of cysteine in protein structure? Name ONE chemical that can be used to disrupt the protein structure formed by cysteine. [1 mark]

C. Are all combination of ϕ and ψ angles in the peptide bond possible? Explain briefly your answer. [1 mark]

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D. What is the difference in hydrogen bonding between alpha helix and beta sheet of protein secondary structures? [1 mark]

E. What is the function of chaperone protein? [1 mark]

F. Name ONE method for the determination of protein 3D structure. [1 mark]

G. What are the principles of the protein separation used in 2D gel electrophoresis? [2 marks]

H. What is the order of elution of proteins on a gel-filtration column? Why is this so? [2 marks]

Question 3

A. Differentiate between a nucleoside and a nucleotide. [1 mark]

B. A single strand of RNA is 20% U. What can you predict about the percentages of the remaining bases? [1 mark]

C. Both DNA and RNA can adopt secondary structure. Name ONE example of this structure. What metal ion can help to stabilize this structure? [1 mark]

D. Name ONE method that can be used to detect complimentary DNA sequence. [1 mark]

E. Define briefly molecular cloning. [1 mark]

F. Name FOUR basic components used in a typical PCR. [2 marks]

G. What does the length of a phylogenetic tree indicate? [1 mark]

H. How do paralogous sequences form? [1 mark]

I. What is the substitution matrix used in protein sequence alignment? [1 mark]

Question 4

A. Describe briefly TWO biological roles of carbohydrates and give ONE example for each. [2 marks]

B. Why does a pure noncompetitive inhibitor not change the observed K_M? [1 mark]

C. Explain how changes in pH can affect enzyme activity. [1 mark]

D. How is the enzyme activity regulated? List FOUR mechanisms. [2 marks]

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E. Suggest a reason why animals that live in cold climates tend to have higher proportions of polyunsaturated fatty acid residues in their lipids than do animals that live in warm climates. [1 mark]

F. Which has a higher stored energy potential per gram, glycogen or triglycerides? Explain. [1 mark]

G. Differentiate between passive transport and active transport. [2 marks]

End of paper